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Cambrian Fossil Localities in Northwestern Vermont

Theokritoff, George

Trip P-2

CAMBRIAN FOSSIL LOCALITIES IN NORTHWESTERN VERMONT

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INTRODUCTION

The Cambrian sections of northwestern Vermont are widely regarded as classic on account of the discovery therein of Cambrian fossils by Zadock Thompson and S.R. Hall in 1847 and Noah Parker in 1954, as well as on account of the variety of the fossils subsequently collected. The first fossils found were described by Elkanah Billings and James Hall. Further discoveries were made by Charles Walcott. More recent paleontological work includes that of Clark and Shaw (1968a; 1968b), Howell (1937), Kindle and Tasch (1948), Rasetti (1946), Raymond (1924; 1937), Resser and Howell (1938), Schuchert (1937), Shaw (1951-1966), and Tasch (1949).

Recent regional syntheses (Cady, 1968; Palmer, 1971; Rodgers, 1968; Theokritoff, 1968) have interpreted the Cambrian rocks of northwestern Vermont as representing, on the one hand, the deposits of a sand-carbonate shelf extending to the west and northwest onto the craton and, on the other hand, the deposits of a deeper water basin situated to the east and southeast. The sand-carbonate shelf formed a steep bank, rising above the basin and contributing carbonate clasts to sites of dominantly shale deposition at the foot of this sand-carbonate bank. The boundary between the shelf facies and the basin facies is now complicated by and partly obscured by thrusting.

The present trip will visit three fossil localities. The first locality is in the Lower Cambrian Monkton Quartzite, the second in the Lower Cambrian lower Parker Shale, and the third in the Upper Cambrian Gorge Formation. The first and the third are in the shelf facies, the second in the basin facies.

It is a distinct pleasure to acknowledge the courtesy of the three gentlemen, owners of private land, who have graciously granted us permission to enter their property: Mr. Oscar Baker of Highgate Falls, Mr. Euclide Duhamel of Swanton, and Mr. Louis Gregoire of Mallett's Bay.

DESCRIPTION OF OUTCROPS AND ROAD LOG

7½' Topographic Quadrangle Maps: St. Albans (Vt.) and Milton (Vt.)

Start from Perkins Geology Hall, UVM.
Proceed to Interstate 89 north to Exit 17 (Champlain Islands).
Exit for Route 2 West.

Mileage

00.0 Enter Route 2 West.

00.7 Cedar Hill Gift Shoppe on left. Park cars at gift shop and walk to top of hill to the south. Fossiliferous outcrops are beneath power-line.

Stop 1 - The rock exposed here is a coarse gray-buff to tan weathering gray sandstone. It is referred to as the Monkton Quartzite. Abundant fossils may be found on weathered surfaces. At this locality, the commonest fossils are trilobite fragments, mostly disarticulated thoracic segments, but recognizable olenellid cephala, probably of Olenellus, and dorypygid cranidia and pydidia, probably of Bonnia, also occur. The fossils are preserved as molds in the sandstone matrix. All are disarticulated but not badly abraded; these circumstances suggest sedimentation and burial in gently moving water. The Monkton Quartzite probably represents a strand-line deposit.

The first systematic description of the fossils from this locality is that of Kindle and Tasch (1948). Further descriptions, with some taxonomic revisions, were published by Shaw (1962).

Return to Interstate 89.

01.4 Take Interstate 89 north to Exit 21 (Swanton), Approximately 25 miles.

00.0 Enter Route 78 West to Swanton.

01.0 Turn left (south) onto Route 7 in Village of Swanton.

02.0 Cross bridge over Missisquoi River.

03.9 Turn left just south of farmhouse on left of highway. Enter lane through gate. The Kelly quarry is just south of this lane approximately 0.1 miles east of the gate.

Stop 2 - The Kelly quarry, described by Schuchert (1937, p. 1035) and Shaw (1954, p. 1041), exposes two rock types in the lower Parker Slate. The lower of these is a dark-greenish-gray weathering gray-green micaceous slate with some interbeds of buff weathering gray laminated fine to medium grained sandstone. Dolomite nodules occur near the top. The upper rock type is a tan-buff weathering light gray dolomite, exposed on top of the knoll above and to the east of the quarry face.

Poorly preserved trilobite fragments may be found in the slate; fragments and external molds of Kootenia are fairly common in the overlying dolomite. Shaw (1954, p. 1041) gave a check list for both horizons.

Dactyloidites asteroides has been reported by Schuchert (1937, p. 1035) and Shaw (1954, p. 1041) from the slates at the entrance to the quarry. Shaw (1955, p. 784) reported a somewhat different form, D. edsoni, from the same locality. Dactyloidites has been described and figured by Ruedemann (1934, p. 28-30, plates 4-6) who thought it was probably algal. D. edsoni was also described by Resser and Howell (1938, p. 210) who thought it was algal. Walcott (1998) thought Dactyloidites was a scryphozoan medusa. Hantzschel (1962, p. W240) and Harrington and Moore (1956, p. F159) consider Dactyloidites to be an unrecognizable form.

Return to Route 7 north.

04.3 Turn right (east) on paved road.

05.6 Stop sign. Turn left (north).

08.3 Turn left (just before steel bridge over Missisquoi River at Highgate Falls) and drive through Swanton Municipal Power plant property to private property owned by Mr. Oscar Baker. Follow the lane to the right and park cars by river. Outcrops are to the east.

Stop 3 - In contrast to the first two stops, the last is dominated by carbonates. This section in the Highgate gorge has been described by Raymond (1924, p. 459), Schuchert (1933, p. 373-377; 1937, p. 1067-1069), and in greater detail by Shaw and Clark (1968).

Schuchert (1937, p. 1070) interpreted a thick breccia in the gorge as a thrust breccia and hence recognized two formations here, separated by this inferred thrust. The upper he referred to the Highgate Formation and the lower to the Gorge Formation. Shaw (in Shaw and Clark, 1968, p. 381) did not recognize a thrust in this part of the section,

interpreting the breccia in question as debris from a submarine land slide, and hence he assigned to the Gorge Formation the strata that Schuchert had referred to the Highgate Formation here.

Several fossiliferous horizons have been noted in the gorge section but the faunas of only some have been described. Clark and Shaw (1968a; 1968b) described the trilobites from bed 3, which is exposed downstream from the most westerly vertical cliff. This bed has yielded two distinct faunas, a lower referred by Clark and Shaw (1968a) and Palmer (1971, p. 176) to the late Dresbachian Dunderbergia zone, and an upper correlated by Clark and Shaw (1968b) with the Hungaia magnifica fauna, known from boulders in Quebec and western Newfoundland (Whittington, 1966, p. 701). Palmer (1971) referred the upper fauna in bed 3 to the late Franconian.

Higher strata have yielded fossils from a number of horizons. The lowest of these is stratigraphically about a foot above bed 3 and is exposed only in the same general locality as bed 3. Its trilobites have been described by Raymond (1924; 1937). Other fossiliferous horizons have been identified by Shaw and Clark (1968) in the most westerly vertical cliff section and in the cliff section to the east, between the two rock dumps. The fossils from some of these have been described by Raymond (1924; 1937) and Rasetti (1946), and have been correlated with the Hungaia magnifica fauna to be Trempealeauan and also correlative of the Early Tremadocian.

00.0 Return to steel bridge at Highgate Falls. Cross bridge.

00.4 Turn left in Highgate Center onto Route 78 west.

04.6 Enter Interstate 89.

REFERENCES CITED

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APPENDIX

Vermont Geological Survey

Publications

All Vermont Geological Survey Publications may be purchased through the Vermont Department of Libraries, Geological Publications, Montpelier, Vermont 05602.

Please include payment with your order. Vermont residents must include 3% sales tax.

*** VERMONT GEOLOGICAL SURVEY BULLETINS ***

1	Geology of the Bradford-Thetford Area, Orange County Vermont by Jarvis B. Hadley, 1950	2.00
2	Stratigraphy and structure of the Castleton Area, Vermont, by Philip Fowler, 1950	2.00
3	Geology of the Memphremagog Quadrangle and the Southeastern Portion of the Irasburg Quadrangle, Vermont, by Charles G. Doll, 1951	2.00
4	A Study of Lakes in Northeastern Vermont, by John Ross Mills, 1951	2.00
5	The Green Mountain Anticlinorium in the Vicinity of Rochester and East Middlebury, Vermont, by Philip Henry Osberg, 1952	2.00
6	The Geology of the Rutland Area, Vermont, by W.F. Brace, 1953	2.00
7	The Geology of the Bennington Area, Vermont, by John A. Mac-Fayden, 1956	2.00
8	The Geology of the Lyndonville Area, Vermont, by John G. Dennis, 1956	2.00
9	The Geology of the Limestone of Isle LaMotte and South Hero Island, Vermont, by Robert B. Erwin, 1957	2.00
10	The Bed Rock Geology of the East Barre Area, Vermont by Varansi Rama Murthy, 1957	2.00
11	The Geology of Concord, Waterford Area, Vermont by Eric and Dennis, 1958	2.00
12	The Geology of the Mount Mansfield Quadrangle, Vermont by Robert A. Christman, 1959	2.00
13	The Geology of the St. Johnsbury Quadrangle, Vermont and New Hampshire, by Leo M. Hall, 1959	2.00
14	Bedrock Geology of the Central Champlain Valley of Vermont, by Charles W. Welby, 1961	4.00
15	Geology of the Camels Hump Quadrangle, Vermont by Robert A. Christman and Donald T. Secor, Jr., 1961	2.00
16	Geology of the Plainfield Quadrangle, Vermont by Ronald H. Konig, 1961	2.00
17	The Green Mountain Anticlinorium in the Vicinity of Wilmington and Woodford, Vermont, by James William Skehan, S.J., 1961	3.00

*** VERMONT GEOLOGICAL SURVEY BULLETINS ***

18	Geology of the Equinox Quadrangle and Vicinity, by Philip C. Hewitt, 1961	2.00
19	The Glacial Geology of Vermont, by David P. Stewart, 1961	2.00
20	Geology of the Island Pond Area, Vermont, by Bruce K. Goodwin, 1963	2.00
21	Bedrock Geology of the Randolph Quadrangle, Vermont, by Ernest Henry Ern, 1963	2.00
22	Geology of the Lunenburg-Brunswick-Guildhall Area, Vermont, by Warren I. Johansson, 1963	2.00
23	Geology of the Enosburg Area, Vermont, by John G. Dennis, 1964	2.00
24	Geology of the Hardwick Area, Vermont, by Ronald H. Konig and John G. Dennis, 1964	2.00
25	Stratigraphy and Structure of a Portion of the Castleton Quadrangle, Vermont, by E-an Zen, 1964	2.00
26	Geology of the Milton Quadrangle, Vermont by Solon W. Stone and John G. Dennis, 1964	2.00
27	Geology of the Vermont Portion of the Averill Quadrangle, by Paul Benton Myers, Jr., 1964	2.00
28	Geology of the Burke Quadrangle, Vermont, by Bertram G. Woodland, 1965	3.00
29	Bedrock Geology of the Woodstock Quadrangle, Vermont by Ping Hsi Chang, Ernest H. Ern, Jr., and James B. Thompson, Jr., 1965	2.00
30	Bedrock Geology of the Pawlet Quadrangle, Vermont, by Robert C. Shumaker and James B. Thompson, Jr., 1967	2.00
31	The Surficial Geology and Pleistocene History of Vermont, by David P. Stewart and Paul MacClintock, 1969	4.00

*** ECONOMIC GEOLOGY ***

Economic Geology No. 1 - A Report on Magnetic Surveys of Uultramafic Bodies in the Dover, Windham and Ludlow areas, Vermont, by Vincent J. Murphy, 1966 3.00*

Economic Geology No. 2 - Report on a Resistivity Survey of the Monkton Kaolin Deposit and Drill Hole Exploration, by Jason A. Wark, 1968 3.00*

Economic Geology No. 3 - Geology and Origin of the Kaolin at East Monkton, Vermont, by Duncan G. Ogden, 1969 3.00*

Economic Geology No. 4 - Report on the Cuttingsville Pyrrhotite Deposit, Cuttingsville, Vermont, by Charles G. Doll, 1969 3.00*

Economic Geology No. 5 - The Geology of the Elizabeth Mine, Vermont, by Peter F. Howard, 1969 3.00*

Economic Geology No. 6 - Magnetic Surveys of Ultramafic Bodies in the Vicinity of Lowell, Vermont, by Vincent J. Murphy and Andrew V. Lacroix, 1969 3.00*

Economic Geology No. 7 - Geochemical Investigations in Essex and Caledonia Counties, Vermont, by Raymond W. Grant, 1970 3.00*

*** ENVIRONMENTAL GEOLOGY ***

Environmental Geology No. 1 - Geology for Environmental Planning in the Barre-Montpelier Region, Vermont, by David P. Stewart, 1971 2.00

*** SPECIAL PUBLICATIONS ***

Special Publication No. 1 - Paleontology of the Champlain Basin in Vermont, by Charles W. Welby, 1962 3.00

Special Publication No. 2 - Mineral Collecting in Vermont, by R. W. Grant, 1968 3.00

*** STUDIES IN VERMONT GEOLOGY ***

Studies in Vermont Geology No. 1 - The Morphometry and Recent Sedimentation of Joe's Pond, West Danville, Vermont, by John S. Moore and Allen S. Hunt, 1970 2.00

Studies in Vermont Geology No. 2 - Surficial Geology of the Brandon-Ticonderoga 15 Minute Quadrangles, Vermont, by G. Gordon Connally, 1970 2.00

*** MAPS ***

1	Topographic Map of Vermont, 1970, scale 1:250,000, contour interval 100'	2.00
2	Centennial Geologic Map of Vermont, 1961, scale 1:250,000	4.00
3	Surficial Geologic Map of Vermont, 1970, Scale 1:250,000	4.00
4	Generalized Geologic Map of Vermont, 1970, 8½ x 11" - each	.15
	In lots of 100 for schools - each	.10
5	Glacial Drift Sheets and Ice Directions - each	.15
	In lots of 100 for schools - each	.10
6	Post Card Generalized Geologic Map of Vermont, 1970, 4 7/16 x 6 7/16"	.10
7	Vermont Geological Quadrangle Maps - Areas Available: Castleton, Concord-Waterford, East Barre, Enosburg Falls, Equinox, Mt. Mansfield, Plainfield, Rutland, St. Johnsbury, Wilmington-Woodford - each	.25

*** STATE PARKS ***

Geology of Button Bay State Park, by Harry W. Dodge, Jr., 1962	.25
The Geology of Darling State Park, by Harry W. Dodge, Jr., 1967	.25
The Geology of Groton State Forest, by Robert A. Christman, 1956	.25
The Geology of Mt. Mansfield State Forest, by Robert A. Christman, 1956	.25
The Geology of the Calvin Coolidge State Forest Park, by Harry W. Dodge, 1959	.25
The Geology of D.A.R. State Park, Mt. Philo State Forest Park, Sand Bar State Park, by Harry W. Dodge, Jr., 1969	.25

*** SPECIAL BULLETIN

Special Bulletin No. 1 - Geology of the Plattsburgh and Rouses Point, New York-Vermont, Quadrangle by Donald W. Fisher, 1968	3.00

*** OTHER PUBLICATIONS ***

The Physical Features of Vermont, by Elbridge Churchill Jacobs, 1950	1.00

1830

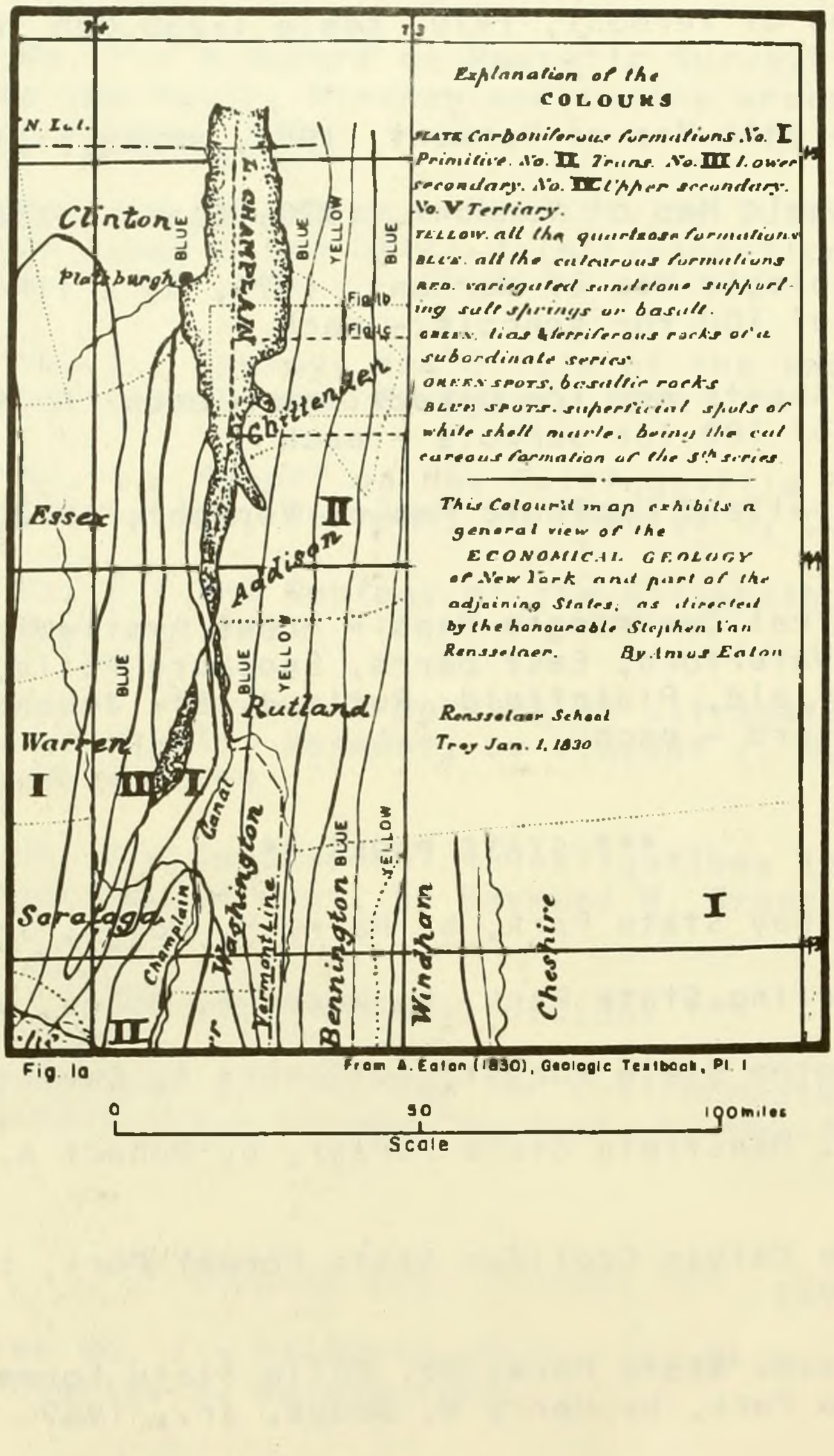

Fig. 1a From A. Eaton (1830), Geologic Textbook, Pl. I

0 50 100 miles
Scale

1861

KEY

(2) Gneiss
(4) Talcose Schist
(11) Chazy, Bird's Eye, and Black River Limestones
(12) Trenton Limestone
(13) Utica Slate
(14) Hudson River Slates
(16) Red Sandrock
(17) Quartz Rock
(18) Georgia Slates
(19) Talcose Conglomerate
(20) Eolian Limestone
(S) Beds of Steatite
(1) Ores of Iron older than the Tertiary

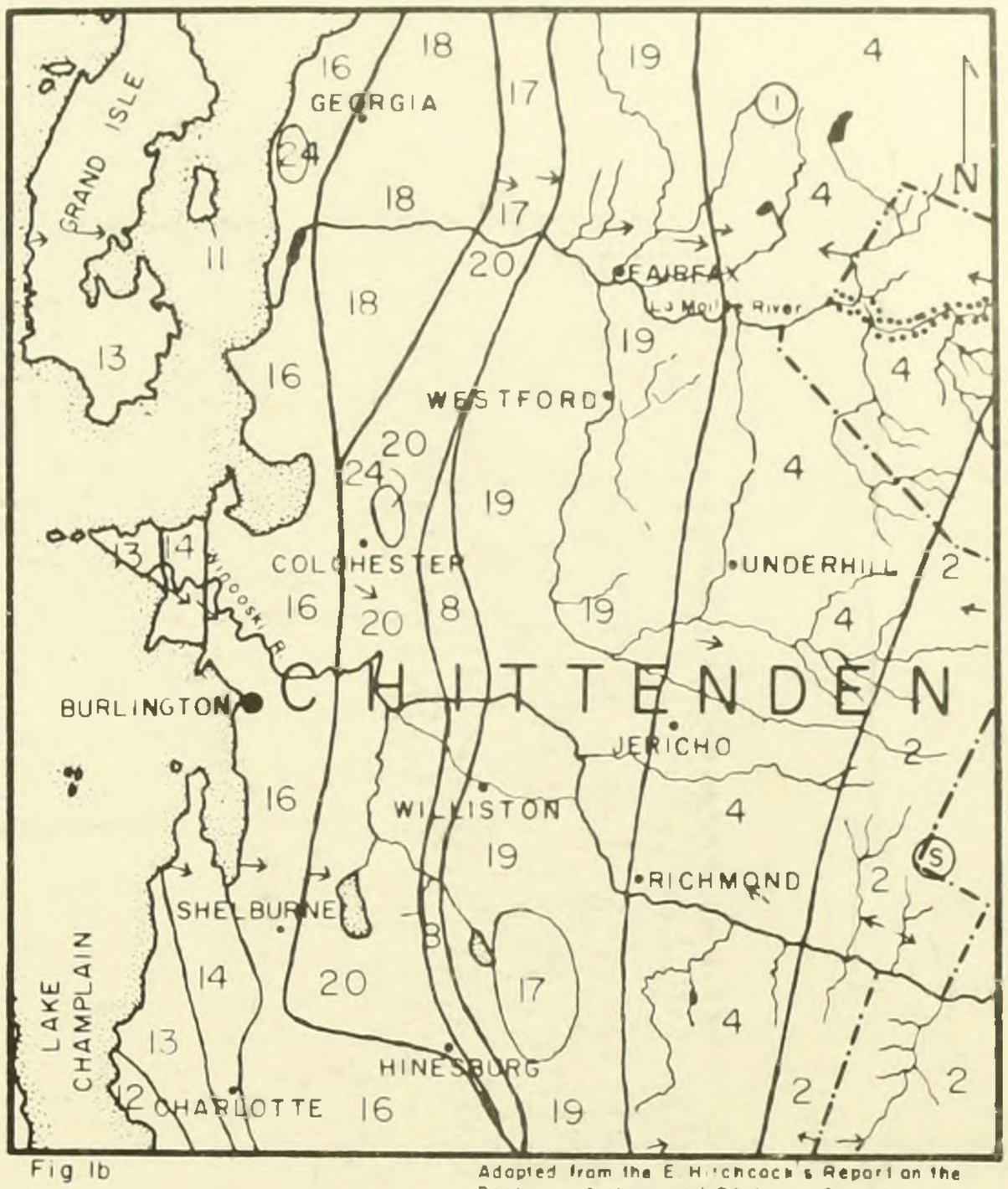

Fig 1b

Adapted from the E. Hitchcock's Report on the Geology of Vermont (1861), vol 2, pl. 1

1961

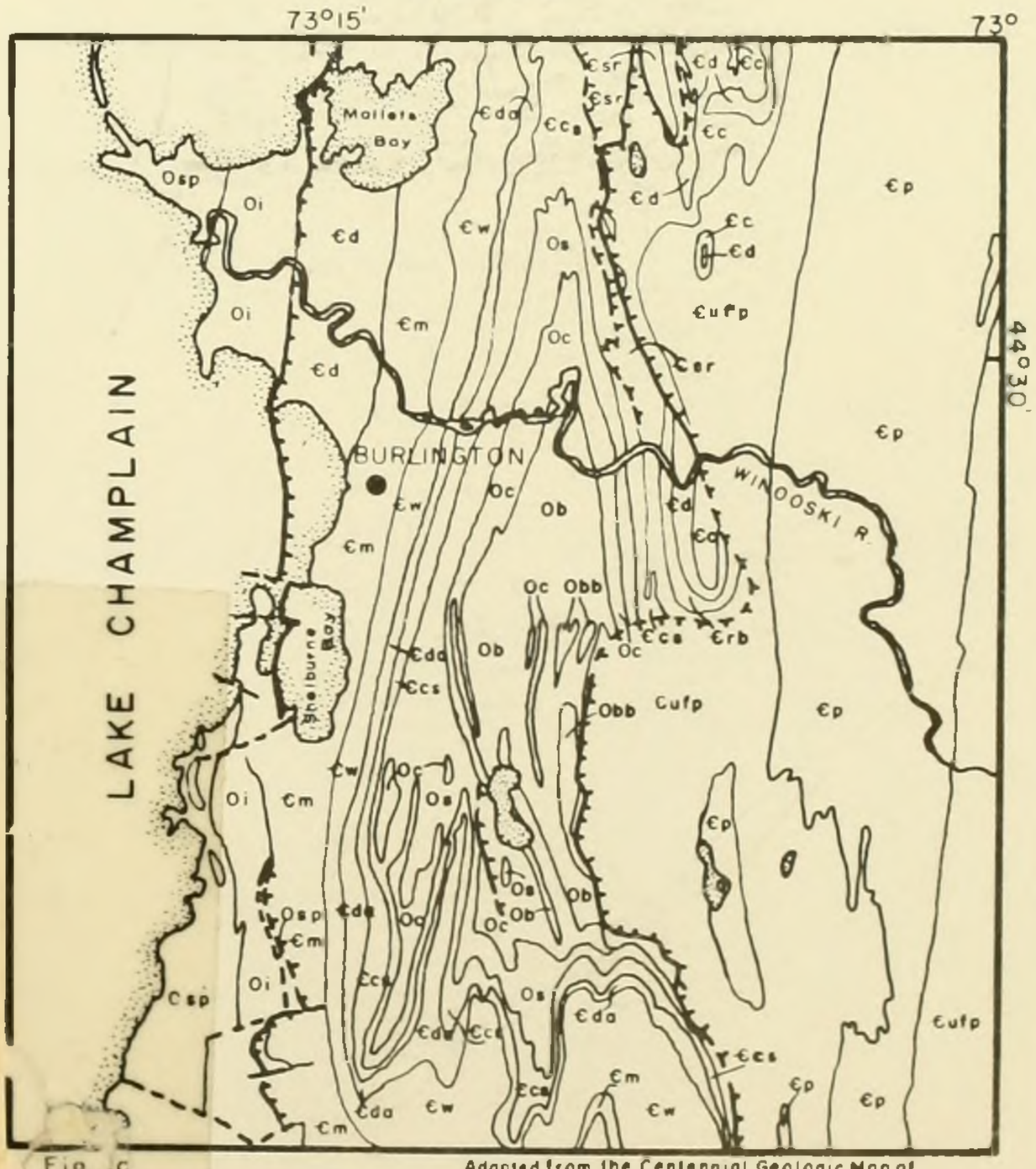

Fig 1c

Adapted from the Centennial Geologic Map of Vermont by Doll et al. (1961).